
CONNECTICUT FLOOD PLAIN MANAGEMENT SERVICES

**EMERGENCY OPERATION PLAN
MOODUS RESERVOIR DAM
EAST HADDAM, CONNECTICUT**

June 1998



**US Army Corps
of Engineers**

New England District

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information including suggestions for reducing this burden to Washington Headquarters Services, Directorate for Information, Observation and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302 and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (LEAVE BLANK)		2. REPORT DATE June 1998	3. REPORT TYPE AND DATES COVERED Flood Plain Management Services	
4. TITLE AND SUBTITLE Emergency Operation Plan Moodus Reservoir Dam, East Haddam, CT			5. FUNDING NUMBERS	
6. AUTHOR(S) US Army Corps of Engineers New England District			8. PERFORMING ORGANIZATION REPORT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) US Army Corps of Engineers New England District 696 Virginia Road Concord, Mass. 01742-2751			10. SPONSORING/ MONITORING AGENCY REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) US Army Corps of Engineers New England District 696 Virginia Road Concord, Mass. 01742-2751				
11. SUPPLEMENTARY NOTES FINAL				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (MAXIMUM 200 WORDS) Moodus Reservoir Dam is located on the Moodus River in East Haddam, CT. This dam is owned by the State of Connecticut. The Emergency Operation Plan (EOP) is a suggested procedural outline indicating appropriate steps to be taken in the event of a possible failure of the dam.				
14. SUBJECT TERMS Dam-Breach Analysis, dam failure, flooding, floodplain			15. NUMBER OF PAGES	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT	

**MOODUS RESERVOIR DAM
EAST HADDAM, CONNECTICUT**

**EMERGENCY
OPERATIONS PLAN**

FINAL

Prepared for

**State of Connecticut
Department of Environmental Protection
Inland Water Resources Division**

June 1998

**DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS 01742**

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GENERAL

INTRODUCTION

Moodus Reservoir dam is located on the Moodus River in East Haddam, CT. The dam is owned by the State of Connecticut. The Emergency Operation Plan (EOP) is a suggested procedural outline indicating appropriate steps to be taken in the event of a possible failure of the dam.

AUTHORIZATION

This plan was prepared under the authority of the Corps of Engineers Section 206 Flood Plain Management Services Program (FPMS), at the request of the State of Connecticut, Department of Environmental Protection (CT DEP), Inland Water Resources Division.

STUDY AREA AND PURPOSE

The study area for this plan is the Moodus River from Moodus Reservoir dam to its confluence with the Salmon River at Salmon Cove. The entire study area is within the town of East Haddam, Connecticut. (See Plate 1.) The principal purpose of the plan is the reduction of the potential hazard to downstream residents and property posed by a dam failure. The plan identifies suggested monitoring and notification actions and inundation areas in the event of an emergency. This plan was prepared based on hydrologic and hydraulic information contained in the draft report "Moodus Reservoir Dam, Dam Breach Flood Analysis" report, prepared by the U.S. Army Corps of Engineers".

EMERGENCY CONDITIONS

Emergency conditions that may cause dam failure include:

- 1) Excessive precipitation resulting in the dam being overtopped and subsequent embankment erosion and dam breach;

- 2) Internal erosion of the embankment (piping) creating voids in the embankment which could lead to dam breach; and
- 3) Earthquake or sabotage resulting in dam failure.

The inundation areas presented in this plan assume excessive precipitation and overtopping of the dam results in its failure. Internal erosion and seepage is a long term condition which should be identified by CT DEP through their periodic inspections. Failure due to earthquake and sabotage are conditions for which advance warning is not available.

PERTINENT DAM INFORMATION

Moodus Reservoir and dam are located in East Haddam, Connecticut. The dam was constructed in 1824. The primary function of the reservoir is to provide water based recreation.

Moodus Reservoir dam is about 17.5 feet high and about 275 feet in length. The dam consists of a 135 feet long earth embankment and a 140 feet long broad crested masonry weir (spillway). The total volume behind the dam at spillway crest and top of dam is 2,940 acre-feet and 4,390 acre-feet, respectively. (See Table 1.)

The outlet works located at the east side of the spillway abutment, consists of two manually operated vertical hoist gates. These gates are no longer used. Normal pool elevation is maintained by flow over the spillway. The spillway discharges to channel leading to a bridge opening beneath Falls Bashan Road, which is immediately downstream of the dam.

Moodus Reservoir Dam has a spillway hydraulic design capacity of approximately 1/4 probable maximum flood (PMF). A plan and profile of the dam is included as Plate 2.

TABLE 1
PERTINENT DATA
MOODUS RESERVOIR DAM

Location: Moodus River, East Haddam, CT

Drainage Area: 10.5 square miles (relatively undeveloped rolling wooded terrain)

Physical Characteristics:

Type:	Earth Embankment
Length:	Approximately 275 feet
Height:	17.5 feet
Top Width:	20 feet (35 feet at left abutment)
Side Slope:	Upstream face 2.5H:1V Downstream face 2H:1V

Impoundment Behind Dam:

Surface Area:	436 acres at spillway crest 534 acres at top of dam
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Volume:	2,940 acre-feet at spillway crest 4,390 acre-feet at top of dam
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Elevations:

Top of Dam:	360.0 feet NGVD
Spillway:	357.0 feet NGVD
Streambed:	342.5 feet NGVD

Spillway:

Length:	140 feet
Type:	broad crested masonry
Capacity at Top of Dam:	2,180 cfs

Outlet Works:

The structure has a 7-foot by 3-foot conduit with an invert elevation of 345.5 feet NGVD. Flow into the conduit is controlled by two gates which are manually operated vertical hoist-gear mechanisms. The outlet works are no longer used and normal water level is maintained by flow over the spillway.

PERIODIC INSPECTIONS

The CT DEP conducts periodic inspections of the Moodus Reservoir to ensure the dam integrity and operational condition of the associated spillway.

EMERGENCY OPERATION PLAN REVIEW

This EOP should be reviewed at least annually by the CT DEP and local authorities to ensure the information presented in the plan is accurate.

DAM SURVEILLANCE

INITIATION OF MONITORING

The dam should be monitored during periods of heavy precipitation, flooding, or any other unusual hydrological event that might cause structural damage to the dam. The CT DEP is responsible for determining when to send the designated monitor to the dam site. In addition, local officials should assist by notifying the CT DEP if they feel an emergency condition is developing at the dam.

In the event of a potential flooding at the dam, the CT DEP, Inland Water Resources Division will notify the appropriate Eastern District personnel. It is assumed that the designated dam monitor will be appropriately trained to recognize the condition of the dam and be able to identify and evaluate specific problem areas. (See Evaluation Section below.)

The Unit Manager for Moodus Reservoir Dam is:

Name: Donald Goss

Address: Gillette Castle State Park, East Haddam, CT

Phone: 860-526-2336

COMMUNICATION SYSTEM

An adequate communication system between the dam monitor and state and local officials should be established.

Primary System. Normal telephone communications. The dam monitor should be equipped with a mobile phone and should have available the telephone numbers of appropriate state and local officials to contact during the emergency.

Secondary System. Shortwave radio. If the phone system is malfunctioning, the dam monitor should have access to a shortwave radio that can be monitored by state and local officials.

FLOOD FORECASTS

During a potential flooding condition, there are two possible sources of flooding information the Connecticut State ALERT System and the National Weather Service in Taunton, Massachusetts. (See Appendix A for telephone numbers.)

- o The Connecticut ALERT system is a flood warning system operated by the CT DEP. Flood forecasting is based on rain gage information.
- o The National Weather Service provides general information on the likelihood of flooding in the area.

EVALUATION

The following is a check list of items that may be used in monitoring the dam. Table 1 provides pertinent data on dam and spillway elevations to assist the monitor in evaluating water levels. The inspection frequency required for a specific event should be at an appropriate interval to allow for identification of any problems. At a minimum inspections should be made every 2 to 3 hours.

(1) Water Surface Level:

(a) Elevation

Normal

High (If so, how high, with respect to the top of dam?)

(2) Spillway:

(a) Condition on arrival

Clear

Blocked (if so, to what extent?)

(3) Top of Dam Crest:

(a) Condition on arrival

Erosion

(4) Downstream Face:

(a) Condition on arrival

Erosion

Evidence of piping

Deficiencies which may be observed include:

- (1) Increased leakage or seepage at the toe of the dam. This would indicate a changed condition that should be monitored.
- (2) Significant seepage on downstream face. This would indicate that a piping failure is imminent.
- (3) Evidence of cracking, settlement, or movement of the dam or spillway or sloughing of the embankment or recent dam movement or instability.
- (4) Overtopping of the dam by wave action.

(This page intentionally left blank.)

NOTIFICATION/EVACUATION PROCEDURES

DETERMINATION TO ISSUE EARLY WARNING

The early warning should be issued when any of the following situations occur, or in the judgement of the dam monitor with concurrence of the CT DEP flood emergency operations center that evacuation of downstream residents may be required within a few hours.

- a. Water rising at a rate that would overtop the dam within several hours;
- b. Significant increase in seepage through an embankment; or
- c. Evidence of some other defect.

An early warning is intended to notify local authorities that conditions at the dam exist which may require evacuation of downstream residents within several hours to avoid loss of life in the event of a failure.

EARLY WARNING

An early warning should be issued to the local authorities in East Haddam. Telephone numbers are provided in Appendix A.

Local authorities have the responsibility of alerting the threatened resident/property owners in the potential flood inundation area of the possibility that evacuation may become necessary. Local authorities should have a prepared plan of how they will carry out the alert.

DETERMINATION TO ISSUE FINAL WARNING

The final warning should be issued when any of the following situations occur or, in the judgement of the dam monitor with concurrence of the CT DEP flood emergency operations center that a failure of the dam appears likely and immediate evacuation of the downstream area is warranted.

- a. Overtopping of dam by wave action;
- b. Cracking or movement of the dam or spillway;

- c. Settlement of the dam crest;
- d. Sloughing of the dam embankment; or
- e. Substantial increase in seepage accompanied by soil particles and muddy water, indicating that piping is occurring.

FINAL WARNING/EVACUATION

A final warning should be issued to the local authorities in East Haddam. Telephone numbers are provided in Appendix A.

Only local authorities have the authority to order an evacuation. The actual order to evacuate should be issued by the local authorities and the evacuation performed by the local authorities.

INSPECTION PRIOR TO REENTRY FOLLOWING OVERTOPPING OR EVACUATION

Prior to allowing reentry of residents or others to the evacuation area, the dam should be inspected by engineering personnel of CT DEP or by qualified engineers retained by CT DEP to determine that the dam is safe and that the emergency is over.

POTENTIAL INUNDATION AREAS ¹

ASSUMPTIONS

The flood analyses and inundation mapping for the dam failure assumes that the reservoir water surface elevation is at the top of the dam with full discharge occurring when the dam fails. The dam breach flood is then superimposed on the pre-existing flood flows within the downstream channel reaches. The analyses assumes a 1/4 PMF inflow to the dam. This discharge together with the 500-year flows from downstream uncontrolled drainage areas is used as the initial flow prior to dam failure.

It should be noted that the dam breach flood analysis assumes high pre-breach flows. Thus downstream flooding would already be occurring prior to dam failure.

INUNDATION MAPPING

The potential water surface elevations, peak discharges, and time to peak that might occur as a result of the failure of Moodus Reservoir Dam is included in Tables 2. The potential inundation areas are included as Plates 3 and 4.

The flood analysis performed does not evaluate the effect of the bridge crossings at North Moodus and Leesville Roads on flood elevations. If these structures remain intact during a dam failure, the peak water surface behind them could increase to a stage higher than estimated. This increase could be as much as 20-25 feet at North Moodus Road and 5-10 feet at Leesville Road. In order to represent the most conservative (worst case) scenario on the inundation mapping, the extent of flooding depicted represents a water level at the top of the road upstream of both North Moodus Road and Leesville Road bridges.

¹ Information presented in this section and in the following table and plates is taken from the "Moodus Reservoir Dam Breach Flood Analysis" report, prepared by the U.S. Army Corps of Engineers.

TABLE 2
MOODUS RESERVOIR DAM FAILURE
DOWNSTREAM CHANNEL ROUTING RESULTS

DAM-BREACH

Downstream Location (River Miles)	Peak Discharge (cfs)*	Peak Elevation (ft NGVD)	Time to Peak Elevation (hours)**	Prebreach Flow Elevation	Increase in Depth of Flow (feet)
Moodus Reservoir Dam (0.0 mi.)	35,550	360.0	0.0	360.0	0
0.058	35,550	348.4	1.6	338.7	9.7
0.237	35,380	281.0	1.6	268.2	12.8
Falls Road (0.573)	35,145	252.3	1.7	245.6	6.7
0.947	34,850	237.4	1.7	230.8	6.6
1.468	34,240	206.8	1.9	198.8	8.0
1.739	34,435*	195.7	1.9	189.5	6.2
1.991	34,385	167.9	1.9	155.1	12.1
2.213	34,365	135.5	1.9	129.5	6.0
Moodus-Leesville Road (2.422)	34,240	118.5	1.9	110.2	8.3
2.564	34,185	83.0	1.9	76.7	6.3
Leesville Road (3.011)	34,110	44.1	1.9	34.5	9.6
Johnson Millpond Dam (3.294)	33,775	41.1	1.9	34.2	6.9
3.828	32,905	12.3	1.9	8.6	3.7
Mouth (4.016)	32,860	10.0	2.1	8.5	1.5
4.290	49,180*	8.5	2.1	8.1	0.4

Note: Prebreach flow elevations given are for the prebreach flow without the dam failing.

* Includes inflow from downstream watersheds

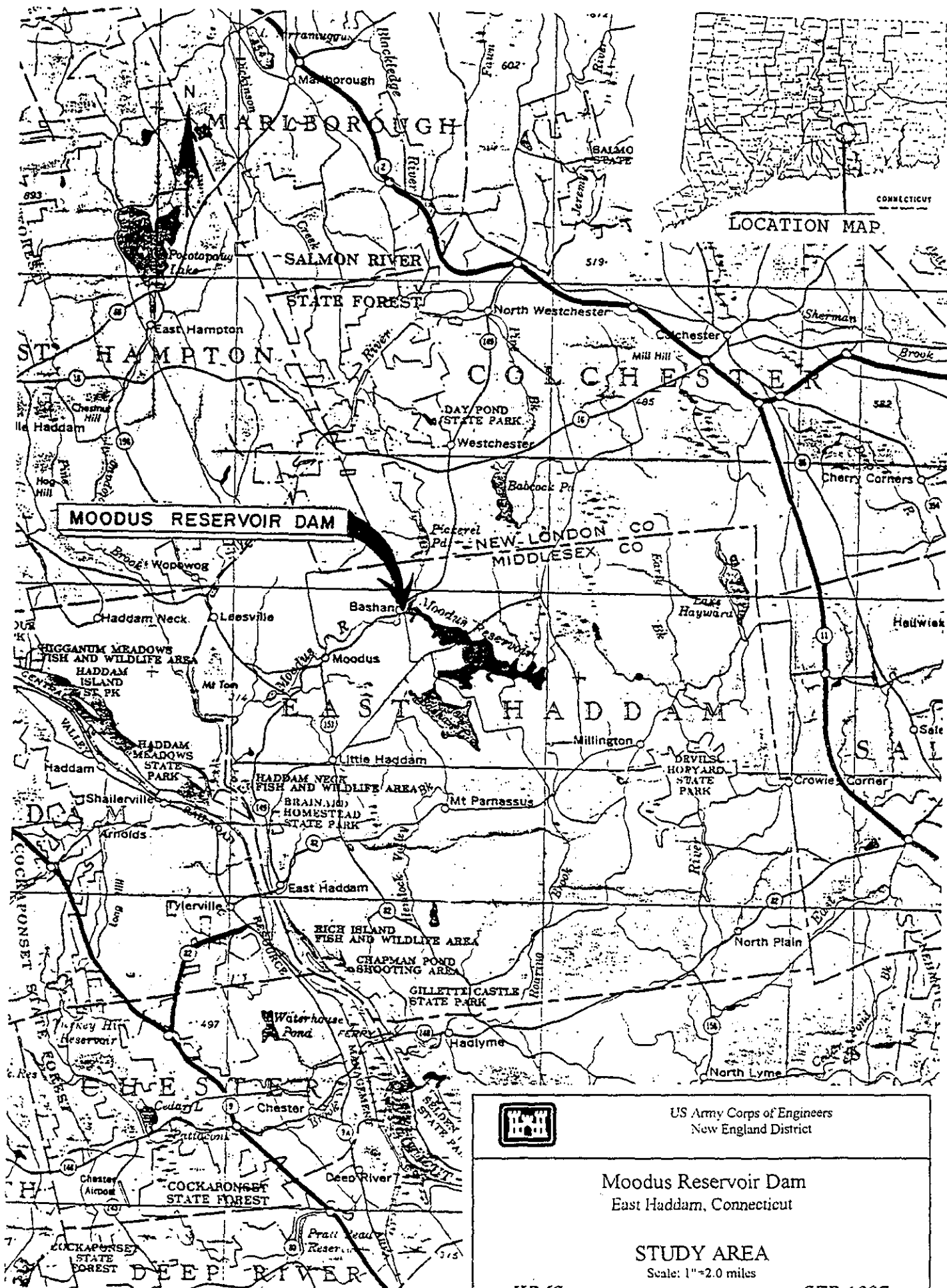
** Time to peak measured from start of breach at Moodus Dam

LIST OF ROADS IN INUNDATION AREA

This list is based on USGS Quadrangle Sheets, Moodus, CT dated 1967 and photo-revised in 1984 and Deep River, CT dated 1961 and photo revised in 1971. The possible extent of flooding is shown on Plates 3 and 4.

- Falls Bashan Road (crosses river)
- Falls Road (crosses river)
- Sawmill Road (crosses river)
- North Moodus Road (crosses river)**
- Moodus Leesville Road (crosses river)
- Leesville Road (crosses river)**
- Johnsonville Road (crosses river)
- Cove Road (on innundation boundary)

** The bridges on these two roads are elevated above the estimated dam-breach flood elevation.



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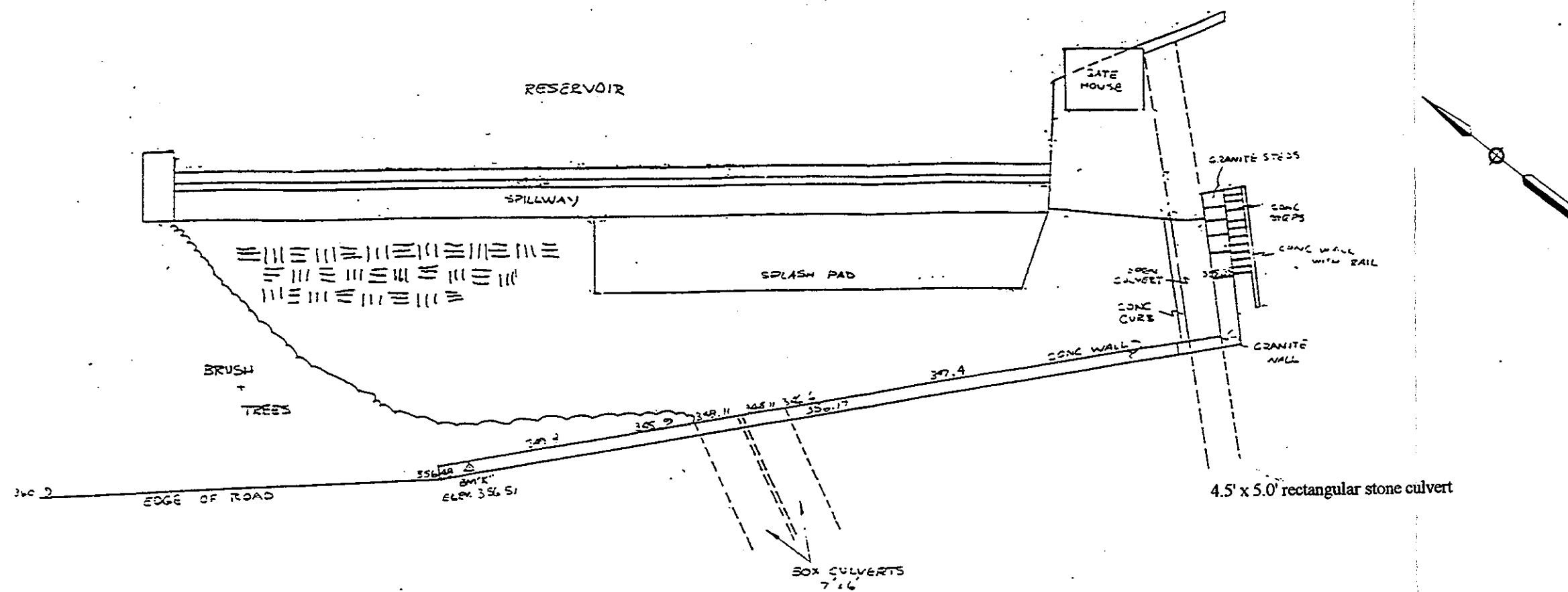
Moodus Reservoir Dam
East Haddam, Connecticut

STUDY AREA
Scale: 1"=2.0 miles

WMS

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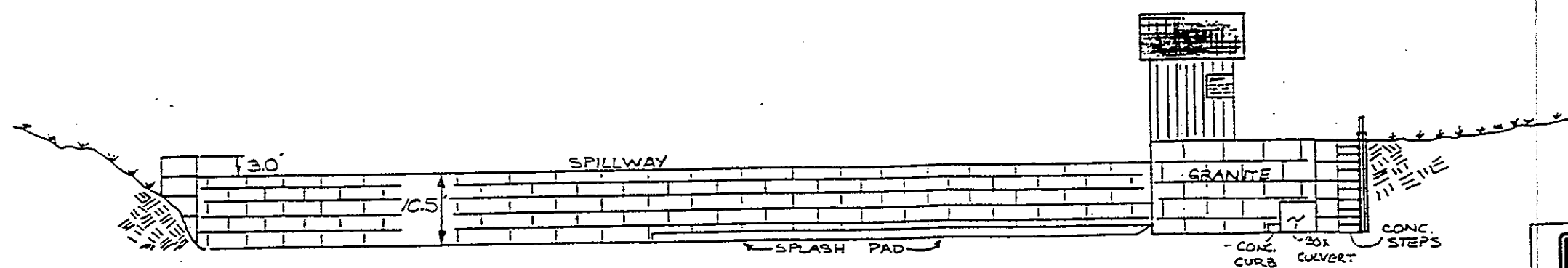
PLATE 1



PLAN VIEW

SCALE

1"=20'



ELEVATION VIEW

SCALE

1"=20'

SOURCE: Connecticut Department of Environmental Protection



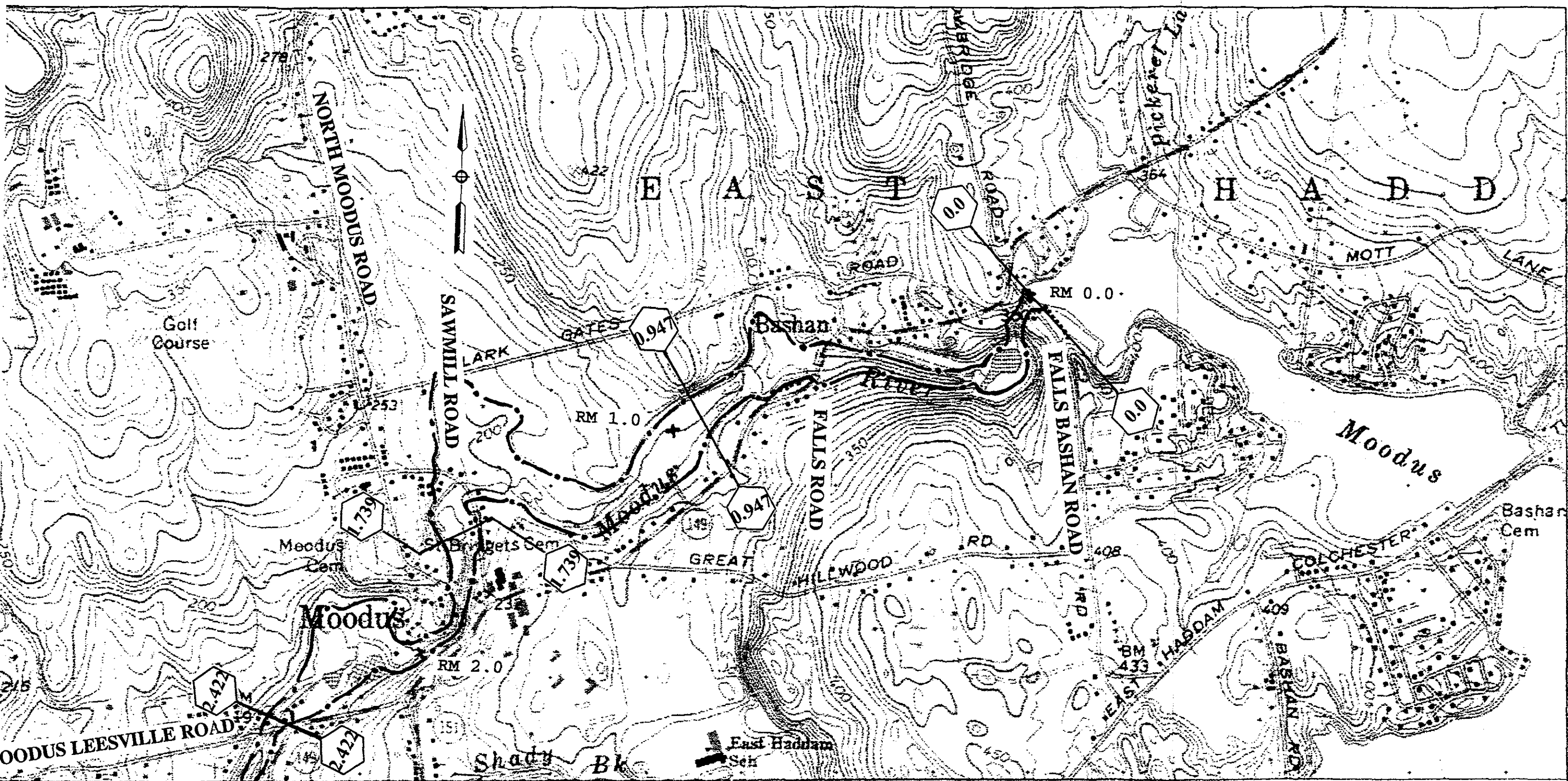
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Moodus Reservoir Dam
East Haddam, Connecticut

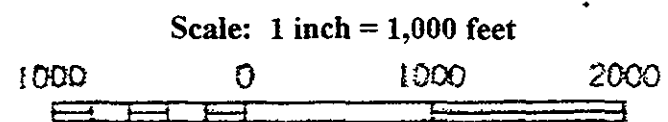
PLAN AND PROFILE

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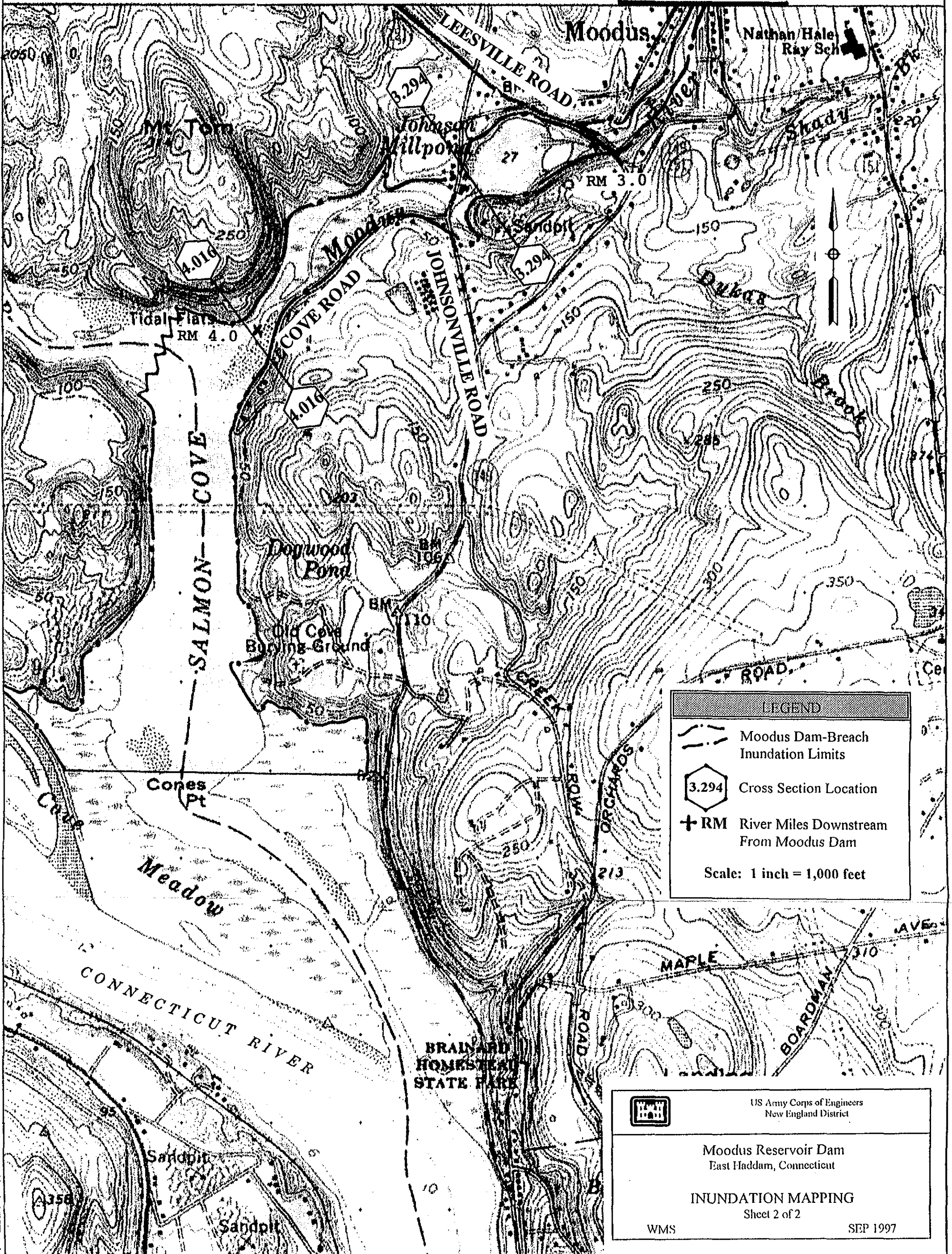


Match Line Sheet 2



LEGEND	
	Moodus Dam-Breach Inundation Limits
	Cross Section Location
	+ RM River Miles Downstream From Moodus Dam

	US Army Corps of Engineers New England District
Moodus Reservoir Dam East Haddam, Connecticut	
INUNDATION MAPPING Sheet 1 of 2	
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LEGEND	
	Moodus Dam-Breach Inundation Limits
	Cross Section Location
	River Miles Downstream From Moodus Dam
Scale: 1 inch = 1,000 feet	

	US Army Corps of Engineers New England District
	Moodus Reservoir Dam East Haddam, Connecticut
	INUNDATION MAPPING Sheet 2 of 2
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APPENDIX A

Telephone Numbers For Information and Reporting

CT DEP, Inland Water Resources Division

Flood Warning System (Doug Glowacki) (860) 424-3706

Dam Safety (Wes Marsh) (860) 424-3887 (direct line)
(860) 424-3706 (office #)

Radio Room (860) 424-3333 (24-hours)

CT DEP, Area Monitor (Donald Goss) (860) 526-2336

Connecticut Office of Emergency Management (860) 566-3180

National Oceanic and Atmospheric Administration

National Weather Service, Taunton, Mass. (508) 823-1900

Town of East Haddam

First Selectman (Susan Merrow) (860) 537-5302

Emergency Preparedness Director (Burton Clark) (860) 873-8272

Selectman (Bradley Parker) (860) 873-8330

Selectman (Emanuel Misenti) (860) 873-9139

Fire Chief (John Blaschik) (860) 260-9794 voice mail

Colchester State Police - Troop K (860) 537-7500